target's displacement. The polarity of the difference indicates displacement direction. After calibration, the microcontroller can convert these difference values to displacement measurements. The microcontroller can also send the sensor ADC's output through the UART block to a PC for additional analysis.

The measurement range for this system is small because the pickup head's design only needs to handle normal variations in the position of a CD's reflective layer. The resolution, however, is excellent. Our detection system, based on modification of a commercial CD optical head, achieved a resolution better than 2 µm in detecting the target's displacement.

J. JAYAPANDIAN, of head of the Electronics & Instrumentation Section (E&IS) of the Materials Science Group of IGCAR in India, has more than 30 years of experience in embedded designs and micro sensors. He holds a dual master's degree in physics and philosophy from the University of Madras and Bharadidasan, Tamil Nadu, India.

K. PRABAKAR, scientific officer with the Electronics & Instrumentation Section, Surface & Nano Science Division, IGCAR, holds a doctorate in physics from Osmania University, Hyderabad, India. His current research interests are microelectromechanical systems (MEMS) and microsensors.

C.S. DEEPAK is a student at IIT, Kanpur-208016. His research interests include microsensors and biological science.

USHARANI RAVI is a scientific engineer with the Electronics & Instrumentation Section of the Materials Science Group at IGCAR. Her current interest is in the area of embedded design for various sensor readouts.

ERIK MATLIN | MAXIM INTEGRATED PRODUCTS INC., SUNNYVALE, CALIF.

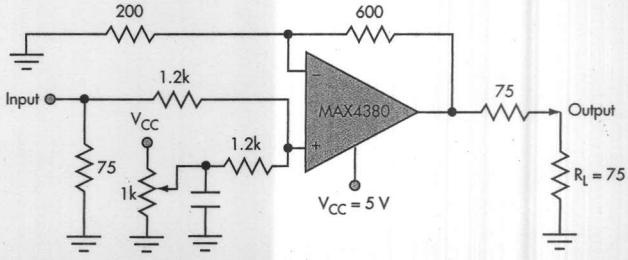
Non-Inverting Level Shifter Requires Only One Op Amp, One Supply Voltage

WITH PORTABLE BATTERY-OPERATED devices continuing to add functionality while shrinking in size, printed-circuit-board real estate becomes increasingly valuable. Single-supply circuitry can help by saving space and cost. Adding audio or video, however, may pose a problem because those signals are usually referenced to ground, and most single-supply ICs must be configured for signals above ground.

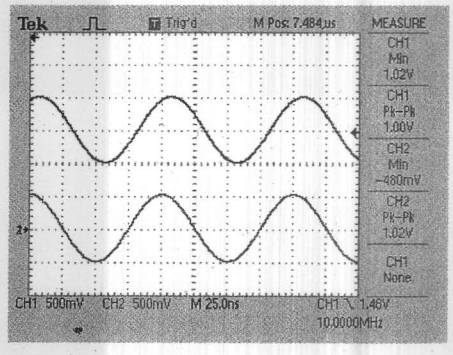
Therefore, the circuit must shift most audio or video input signals to an appropriate level above ground. Also, polarity must be preserved for video signals. Unfortunately, using a single-supply voltage while preserving signal polarity is impossible with traditional op-amp level shifters, which require two op amps and a negative rail.

The circuit in Figure 1 meets all of these requirements, level-shifting a ground-referenced signal with one op amp while running on a single-supply voltage. The op amp's non-inverting summing configuration creates the level-shifted output by summing a reference voltage with the input signal. A standard potentiometer with a bypass capacitor sets the reference voltage, but any voltage reference able to provide enough bias current for the op amp and summing resistors will suffice.

This example circuit includes the 75-Ω termination resistors required in a standard video application. The op amp shown features a small footprint plus the wide bandwidth needed for video. Figure 2 shows the circuit's operation, shifting a 10-MHz ground-referenced input signal by +1.5 V.



1. This non-inverting level shifter allows designers to shift the input signal by a reference voltage, which is determined by the potentiometer and bypass capacitor. The circuit uses only one op amp and one supply voltage.



2. The blue trace (bottom) is the circuit's 10-MHz ground-referenced input signal and the yellow trace (top) is the output, which is level-shifted by +1.5 V.

ERIK MATLIN is an MSEE student at the University of California, Santa Cruz. He also will be joining Maxim this summer.